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The role of green innovation in promoting sustainable economic development in Gweru, Zimbabwe

Wilson Mabhanda
Midlands State University, Zimbabwe
wilsonmabhanda@gmail.com

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Abstract

Purpose: In developing countries, such as Zimbabwe, the nexus between green innovation and sustainable economic development has not been thoroughly investigated. To fill this gap, this study examined the role of green innovation in promoting sustainable economic development in Gweru and Zimbabwe.

Research Methodology: Interpretivist philosophy underpinned qualitative data collection through a multi-case study method and thematic analysis approaches. Fifteen purposively and conveniently sampled participants participated in face-to-face interviews and focus-group discussions.

Results: The study's findings revealed that green innovation was a precursor to sustainable economic development through the reduction of carbon emissions and climate change, supply of clean energy, and increasing agricultural production, all of which enable employment generation and improved standards of living.

Limitations: This study was limited to only green solar entrepreneurs in Gweru City, and other cities were not covered. The study was qualitative; hence, the results cannot be generalized to other cities in the country.

Contributions: This study contributes by expanding the body of knowledge on the green innovation agenda for Small to Medium Enterprises in the solar power systems of Zimbabwe; in addition, the use of protection policies can stimulate friendly environmental businesses in all sectors of the economy.

Keywords: *Carbon emissions; Climate change; Green innovation; Sustainable economic development*

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1. Introduction

Green innovation (GI) has gradually gained recognition not only as a powerful tool in promoting sustainable economic development but also as a contributor to the reduction of carbon emissions in a context where there is an increasing demand for and use of clean energy. Several countries, including Zimbabwe, are increasing their efforts to preserve environmental quality. Currently, the quality of the environment is worsened by spiking temperatures, which lead to devastating floods and droughts that damage flora and fauna (Najmi, Kanapathy, & Aziz, 2021). Thus, green innovation is essential for achieving cleaner environments. This could boost sustainable and competitive businesses and address the challenges caused by climate change. In Zimbabwe, green entrepreneurs are encouraged to take advantage of the call for new economic policies that enable reasonable and responsible businesses to preserve the environment and fulfil stakeholder demands. Recently, entrepreneurs in SMEs have begun to realize the need to develop and deploy products and trending technologies that promote environmental sustainability and stimulate economic performance (Sadiq et al., 2022; Savarese, Huybrechts, & Hudon, 2021). At the height of climate-related problems, it is imperative for green

businesses to foster green innovation and ensure environmental sustainability (ES). The researcher is motivated to conduct this study to develop mitigation strategies to reduce the adverse destruction of the environment through the adoption of green innovation technologies such as solar power technologies. Researchers underline that a reduction in carbon emissions ultimately improves ES and competitive advantage (Ahmed, Zhang, & Cary, 2021).

From the perspective of SMEs, green entrepreneurs are emerging as a key branch of economic drivers of innovation (Asadi et al., 2020). Similarly, new products and services are emerging and forging a significant contribution to the growth of green economies. I. Ali et al. (2020) argue that green SMEs are being hailed for being critical in the overall performance of business and critical in sustainable innovation in emerging economies such as Zimbabwe. Shin, Kim, Jung, and Kim (2022) emphasise that green innovations encourage enterprises to manufacture eco-friendly products through minimising resource utilisation and wastage. This will enable sustainable economic development.

Despite government efforts and initiatives to promote and direct enterprises to go green in the areas of manufacturing and production, the current green entrepreneurs in Zimbawe still face hurdles in their operations. The effects of human activity and green emissions remain a cause for concern. Yet GI is regarded as a tool that reduces greenhouse gas emissions and conserves the environment from destructive human activities (Ibrahim, Ozturk, Al-Faryan, & Al-Mulali, 2022). Xie, Huo, and Zou (2019) underscore that although GI mitigates negative environmental impacts and improves economic performance through reduced waste and costs, the levels of innovation adoption still pose problems. These trends show that there is wide-scale destruction of the environment because of human activity. However, researchers have noted that enterprises are attracted more to economic benefits than to social and environmental conservation (Asadi et al., 2020). Nonetheless, various big and small organizations were pressured to pay heightened attention to environmental management through legislation (Hao, Guo, & Wu, 2022).

Green innovation is a progressive tool or strategy for fostering businesses that manage environments for sustainable economic development. Being pro-environmental through GI brings about substantial advantages, including increasing productivity, lowering costs, ensuring superior products and services and offering enterprises a competitive edge (Al Doghan, Abdelwahed, Soomro, & Ali Alayis, 2022; Xue et al., 2022). Green innovation has recently attracted global attention. It is increasingly receiving significant attention from developing countries such as Zimbabwe.

Green innovation in Zimbabwe, like in other developing and developed countries, is regarded as a technology facet that enables organizations to manufacture eco-friendly products through minimization of both utilization of resources and wastage to accomplish sustainable development (Shin et al., 2022). Green products provide reduced environmental and social impacts due to green processes that act as significant drivers of sustainable economic development (Shahzad, Qu, Zafar, Ding, & Rehman, 2020). Nonetheless, the adoption of GI practices is fraught with concerns and challenges such as issues related to knowledge, awareness, market demand, environmental policies, and financial barriers (Forcadell, Úbeda, & Aracil, 2021).

Li et al. (2020) argue that besides concerns that impact on green entrepreneurs GI requires support and encouragement through imperative monitoring policies and green technologies. Scholars envisage the need to adopt strategies that counter environmental deterioration and climate change to arrest hazardous emissions and pollution (S. J. Khan, Dhir, Parida, & Papa, 2021) This will significantly promote green operations in line with significant benefits in which institutional frameworks, processes, materials and innovative goods and services are realised. The literature shows the possibility of novel technology being upscaled by groups or individual entrepreneurs in order to achieve sustainable economic development (Awan, Arnold, & Gölgeci, 2021; Kartika & Medlimo, 2022). Current studies encourage progressive entrepreneurs to use GI practices to reduce adverse effects on the environment and achieve sustainable economic development through competitive advantage (Awan et al., 2021).

This means that the country has growing potential to tape clean technologies that can help address intermittent power supplies in Zimbabwe. Green solar energy can complement hydroelectricity, which has been inadequate in Zimbabwe over the past three decades. Zimbabwe recently discovered lithium minerals, often referred to as "white gold". Lithium, the second-place precious mineral after gold, is essential for the production of solar panels and rechargeable batteries that power electric vehicles. This means that the country has vast untapped resources for the generation or production of clean energy, which can reduce its negative impact on the environment. Hence, investigating the role of green innovation in promoting sustainable economic development is crucial, particularly regarding the benefits derived from GI. As such, this serves as a motivation for this study.

There have been recent calls for businesses in Zimbabwe to engage in safe business that respects the environment in order to reduce the negative impacts of climate change on the living environment. Nevertheless, governments must strengthen the call for green innovation and financially support it to enrich the energy mix, such as through solar energy (Zeng, Tanveer, Fu, Gu, & Irfan, 2022). Green entrepreneurs are also more worried than before since their businesses are frequently affected by power shortages. However, GI has the potential to benefit a firm's operations by providing cheaper and cleaner solar energy power (He et al., 2021).

1.1 Why does green innovation contribute to sustainable economic development in Gweru City, Zimbabwe?

Efforts to ensure that business reduces its negative impacts and increases its positive effects on environment and socio-economic dimensions of sustainability have resulted in sustainable economic development (Supheni, Ivada, Novianti, & Wiwin, 2022, 2023). Sustainable economic development is currently a concern of several countries, as well as the Zimbabwean government, as it attempts to encourage businesses to adopt green innovation that reduces the use of fossil fuels, which is detrimental to economic sustainability. Gweru City is the hub and center of agricultural and mining activities. As such, the mining and agricultural city faces vast problems of environmental degradation due to excessive exploitation of nature for economic livelihood (Hák, Janoušková, & Moldan, 2016). According to II. Ali et al. (2020), they argue that green SMEs are being hailed for the overall performance of businesses that observe the adoption of eco-friendly business practices. To reduce the volume of carbon emissions from economic activities, the government of Zimbabwe has implored solar technology companies in Gweru to encourage consumers to use clean solar energy. Under this score, green innovation promotes environmental sustainability because trending technologies stimulate economic performance (Sadiq et al., 2022).

Moreover, the United Nations introduced Sustainable Development Goals (SDGS) to protect and improve the environment and society (Hák et al., 2016). Gweru City has adopted anti-carbon production policies, and many companies such as Chinese industries in Gweru are taking a positive move by escalating solar power technologies that promote green technology and mitigate negative climate change in the city. The dump sites that have been deposited near housing settlements are now being reused to improve road infrastructure development in the city. The Gweru city local government is responding to improve sustainability by upholding critical initiatives through evaluating the social, economic and environmental aspects of green technologies as solutions to attain economic sustainability (Shahzad, Qu, Zafar, & Appolloni, 2021).

Sustainable development (SD) has gained substantial attention in the manufacturing industry in Gweru owing to increased awareness and perceived benefits for society through the use of green technologies (Shahzad et al., 2020). The city is currently recycling waste, and a new recycling plant is under construction to sustainably manage the environment. Greening activities and green innovation have become hot topics in Gweru City. New housing settlements are encouraged to adopt green solar technology because they are cheap, clean, and environmentally friendly. Whilst on one hand Farmers in nearby farms are now transitioning to solar-powered irrigation systems. There is plenty of solar energy in Africa, which offers several opportunities for the adoption of clean energy technology. Thus, green innovation encourages enterprises to manufacture eco-friendly products by minimizing resource

utilization, carbon emissions, and waste (Shin et al., 2022). Ibrahim et al. (2022) believe that green innovation is regarded as a tool that reduces greenhouse gas emissions and protects the environment from destructive human activities. Against this backdrop, Gweru City has become the first research site on green innovation for sustainable economic development. Gweru City has earned traction on activities upholding green innovation more than any other city in Zimbabwe, hence becoming the researcher's motivational research area.

In Zimbabwe, little is known about small enterprises that have adopted green innovation in their businesses vis-à-vis the wakeup call to protect the environment from wanton destruction in the name of economic growth. Green innovation has been the subject of numerous studies, mostly by Western and European scholars (Tang, Xu, Hao, Wu, & Xue, 2021). Few studies have been conducted in developing countries, and no significant articles have been identified in Zimbabwe. Hence, an examination of the role of GI in promoting sustainable economic development in Zimbabwe is justifiable. To address this research gap, this study attempts to answer the following questions:

Q1. What is the role of green innovation in sustainable economic development in Gweru city, Zimbabwe?

The remainder of this paper is organized as follows. Following the introduction, the next section articulates the relevant literature on the role of green innovation in promoting sustainable economic development in Zimbabwe. This section discusses the theoretical and empirical literature in detail to bridge the literature gap. The methodology of the study is addressed to explicate the data collection analysis and effectively address the research question of the study. The results and discussion are presented in section. The conclusion, study suggestions, and limitations of this study are discussed.

2. Literature Review

2.1 Conceptual clarification

Green innovation has become universally and nationally important, even in developing countries such as Zimbabwe. Scholars from numerous academic discourses have defined GI in several ways. Green innovation is widely regarded as a concept that entails the production or exploitation of a good, service, process or management (Ma, Hou, Yin, Xin, & Pan, 2018). This is a business method that is novel to the firm and results in a reduction in environmental risk (Ma et al., 2018). GI is multidimensional and can be holistically adopted to enhance good business practices that mitigate the adverse effects on the environment during and after the production of goods and services. On the other hand, Chen, Lai, and Wen (2006) describe GI as a hardware or software innovation that is related to green products or processes that comprise technology-innovations involved in energy saving, prevention of pollution, waste recycling, green product designs or organisation environmental management. This study adopts and uses Chen et al. (2006) because it captures multi-company operations that define innovative practices cognisant of environmental stewardship. It is worth mentioning the designations attached to green innovation in secular literature. Green innovation refers to environmental, eco-, and sustainable innovation (Y. Luo, Lu, & Wu, 2023). This study uses these terms interchangeably, because their meanings are the same.

2.2 Sustainable economic development

Over the past three decades, sustainable economic development has gained interest among policymakers and researchers. The present article attempts to define this concept for the purpose of understanding the underlying meaning, as it is used in several ways by many experts. Accordingly, Espinosa, & Carreiro, (2021) sustainability of growth and economic development focuses on the coercive state intervention to increase the production and distribution of goods and services through taxes, regulations, deficit spending and debt accumulation to increase prosperity for all generations. Sustainable economic development's main focus is on governments, nations, and businesses conducting their operations with the desire to protect their environments. The environment serves the needs of both present and future generations. For instance, entrepreneurs develop new approaches, products, services, or business models that challenge the status quo and offer unique and sustainable solutions to the

environment (Sulaiman, Fitralisma, Fata, & Nawawi, 2023). Thus, a greener built environment can attract businesses and workers for whom environmental sustainability is valued.

The formulation of Sustainable Development Goal (SDG) number 17 was based mainly on three areas of social, environmental, and economic development. Interlinked economic practices include green supplier management, customers, green management, and internal green management (Moslehpour, Chang, & Dadvari, 2022). According to Semasinghe (2020, p. 52), development refers to changes in material indicators, such as GDP, GNP, individual income and wealth, and local and foreign investments, as well as more comprehensive qualitative measures, such as poverty, inequality, self-esteem, dignity, happiness, democracy, and freedom. To achieve sustainable economic development, human activity must be controlled and monitored to ensure that any form of development does not adversely affect the environment.

2.3 What are the scientific debates on green innovation in sustainable economic development worldwide?

The Agenda 2030, under the 17 Sustainable Development Goals (SDGs), aims to eradicate poverty, establish socio-economic inclusion, and protect the environment (UNSD, 1992). In line with the current scholarship, developed countries' SDGs are the pillars of economic, social, and environmental issues, which are more significant than in developing countries. Likewise, to achieve sustainable development, developing countries need to upscale their efforts by focusing more on the economic and social pillars of SDGs than before (Bali Swain & Yang-Wallentin, 2020). Feasible development may be challenging unless otherwise because the social and economic sustainability of nations is pivoted on attaining SDGs. Nevertheless, the unfortunate part of the grand aim of SDGs is flawed if we have to consider that everything (goal) is a top priority, meaning there is no priority, as such SDGs might be unattainable, an indication of many challenges (Bali Swain & Yang-Wallentin, 2020). Failing to attain these important pillars for economic development makes it worth noting that the same challenges impede the economic sustainability of nations. Every country needs to achieve the SDGs to secure their survival and sustainable economic development (Tu et al., 2023).

According to the Bruntland Commission's report in 1987, sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNSD, 1987). In order to achieve sustainable development human decisions are currently based on the areas of the environment, economy and society (Yang, Jahanger, Usman, & Khan, 2021). A clean environment ensures life security with clean water and food, which are SDGs. Critically, human decisions are instrumental to resource allocation. These resources are key to achieving economic sustainability. Similarly, economic sustainability positively impacts economic development.

X. Luo and Oyedele (2021) assert that green innovation's primary purpose is to lessen the harmful influences of human economic activities on the environment in order to accomplish the goal of sustainability. Furthermore, green innovation enhances transformation, where new technology eliminates outdated means of production. Recently, GI has provided the possibility of economic growth by improving social welfare and improvement through less resource utilization, consequently preserving the environment (Wang, Lian, & Lin, 2016). GI designs and products generally emit less greenhouse gases than fossil fuels do. Thus, it helps mitigate the effects of climate change while improving the security of energy supply and providing cleaner energy services (Appiah, Anderson Akolaa, & Ayisi-Addo, 2022).

The installation of photovoltaics and their maintenance has created job creation opportunities in Zimbabwe and around the world by 2050 (Niamir, Ivanova, Filatova, Voinov, & Bressers, 2020). X. Luo and Oyedele (2021) also note that by adopting GI, the green entrepreneur firms are compelled to build energy management practices, which are ideal in that they enhance clean energy and energy saving practices. China has made strides in the use of green innovation, whereby solar-powered technologies are accelerating their economic development. Solar power has been found to promote energy

conservation and sustainable economic development, combat climate change, and reduce carbon emissions (Kumar et al., 2023).

The literature has argued that feasible economic sustainability is currently achieved through green technologies; for instance, green technology is a dominant tool for reducing carbon emissions. Green innovation has emerged as a critical tool for lowering dangerous emissions worldwide (Maasoumi, Heshmati, & Lee, 2021). Green innovation (GI) is defined as a process of new ideas, goods and environmentally friendly services (Sharif, Raza, Ozturk, & Afshan, 2019). GI drives a reduction in production costs. When enterprises reduce production costs, it becomes more feasible for them to improve their research and development so that they understand the factors that influence environmental degradation and make it possible to reform ecologically friendly environments (Awan et al., 2021). GI is an important tool around all facets of economic development; moreover, it triggers the creation of new technologies, products, and methods for preserving environments from destruction. GI enhances the use of renewable energy sources (Samour, Baskaya, & Tursoy, 2022) and successes have been celebrated in China.

However, the main basis of this argument stresses that the main goal of sustainable development is achieving a low- and zero-emission economy, which is part of the "green economy" concept (E. B. Ali, Anufriev, & Amfo, 2021). Challenges do arise around the world as countries strive to balance economic development and CO2 emission reduction, notably in China. Companies are now more concerned about the societal and legitimate pressures and green practices that are being adopted to achieve economic sustainability. Building on green innovation, it is being adopted globally for its advantages and competitiveness for the private sector's productivity and sustainability (P. A. Khan, Johl, & Johl, 2021). The economic sustainability of any country is pivoted on its ability to manage its resources in a friendly manner vis-à-vis its environment. Singh, Del Giudice, Chierici, and Graziano (2020) confirm that to make plausible benefits of sustainability-oriented activities, many firms worldwide have initiated green activities. Green innovation is indeed the key to ecological initiatives and is significantly connected to social and environmental practices (Bai, Song, Jiao, & Yang, 2019). The quality of any company's operations reduces its negative impact on the environment.

Many businesses and governments alike have started to focus on green innovation, bearing in mind its influence on the SDGs for economic development around the globe. Green innovation has been used as an alternative to ecological, sustainable, environmental, and eco-innovation in the field of technological, social, and environmental research (Schiederig, Tietze, & Herstatt, 2012). In contrast, economic sustainability, according to Baumgartner and Ebner (2010), refers to a scenario in which enterprises are made more efficient and effective to sustain competitive market positions. ling Guo, Qu, and Tseng (2017) state that the ecological modernisation theory is a framework which is associated with environmental policy, premised on achieving climate change mitigation and environmental sustainability. Ecological modernization theory supports the idea of preserving the environment from destruction caused by human activity in the name of business. Within this view, any national government is responsible for decisive efforts to protect the environment from negative economic development activities (Ahmed et al., 2021). The literature currently delivers green innovation as a default strategy to preserve environments and stimulate economic sustainability through new management practices, processes, and new products and methods of production (Mirzaei & Esmaeilzadeh, 2021).

Building on the above discourse, environmental economic theory sheds more light on the fact that economic sustainability cannot be achieved without due cognition of social welfare functions. In general, improvement in the optimal allocation of resources is not achieved in many cases without using or considering financial statements as a basis for decision-making to attain company sustainability (Ramdani & Prayitno, 2023). To achieve sustainability economics, there must be a measure to balance the competing values in terms of the allocation of scarce resources. Numerous firms worldwide have adopted green innovation to achieve economic sustainability (Wang et al., 2016). Waste materials are being recycled, which reduces environmental pollution and contaminates the surroundings. The

literature notes that solar power generation is not usable throughout, because it ceases at sunset. For instance, biogas can be used as an alternative source, stored, and used conveniently in case of need (Alhijazi, Almasri, & Alloush, 2023), which is the beauty of green innovation. Developing countries such as Zimbabwe may further have opportunities to create employment through the generation of power from biogas and wind-driven energy, which may not be very expensive compared to the hydrogen economy. Nevertheless, solar energy has availability opportunities, and Africa has high sun exposure and is more affordable.

GI enhances prosperity by utilizing fewer resources and simultaneously preserves the environment from wanton destruction from human economic activities. Green innovation uses new processes and management models that are more environmentally friendly and mitigate adverse effects on the environment during production. As an incentive to the adoption of green innovation customers are willing to spend extra for GI and eco-friendly items to improve environmental work by eliminating natural peril (Zhuang, Yang, Razzaq, & Khan, 2022). Many individuals, firms and large companies have turned to GI as a means of achieving sustainability and economic development (Kneipp, Gomes, Kruglianskas, Motke, & Frizzo, 2021). Many firms around the globe are now fervent to use GI to command higher prices for eco-friendly goods, harnessing brand image, market eco-friendly products and services even in new markets (Mubarak, Tiwari, Petraite, Mubarik, & Raja Mohd Rasi, 2021).

To achieve sustainable economics, firms must adopt green innovation. This is accompanied by changes in the products, practices, and processes. Therefore, changes in values and philosophy are considered, particularly in the social, economic, and environmental dimensions. This is possible because Eiadat, Kelly, Roche, and Eyadat (2008) emphasized that green innovations focus on implementing environmental management systems in organisations by focusing on preventing pollution and reducing waste. In their study of China, Nan, Wang, Wang, and Wu (2022) investigated the role of green innovation in economic growth and carbon emissions. The results indicate that when green innovation was high, the detrimental effect of economic growth had a carbon reduction effect. In support of the above findings, Y. Luo, Wang, et al. (2023) asserted that economic activities reduce the harmful influences of economic activities on the environment and improve economic sustainability.

Recently, Polas et al. (2023) investigated the effects of adopting green innovation as a clean energy strategy among rural entrepreneurs in Bangladesh. Green energy technologies, such as solar energy, mediate environmental concerns and attitudes towards the adoption of GI. Thus, eco-sustainability is a precursor to sustainable economic development in the emerging economies. Andersen, Ogallo, and Diniz Faria (2022) focused on green economic change in Africa, particularly on green and circular innovation trends, conditions and dynamics in Kenyan companies. This study investigated how African countries, exemplified in Kenya, experienced a green and circular structural change in their economies. The effectiveness of green innovation is based on adequate capital resources. It was also noted that a shortage of capital was a significant barrier to the success of green entrepreneurs in developing countries. In recent decades, there has been an increase in the demand for cleaner energy resources (Maka & Alabid, 2022), and its adoption has heightened economic sustainability.

Nonetheless, the adoption of GI practices is fraught with concerns and challenges such as issues related to knowledge, awareness, market demand, environmental policies, and financial barriers (Forcadell et al., 2021). Popular policies, initiatives, and programs are being undertaken at both the European Union level and Finland's national level to foster green innovations. In Europe, GIs is considered a crucial factor for strengthening and enabling the development of technologies, business models, and institutional structures (Bahn-Walkowiak et al., 2021). The importance given to green innovations in the European Union has been that they have taken serious actions to face the current environmental issues to reach a sustainable society. In 2021, Finland was the second most eco-innovative country in the EU, given its high prominence attached to GI and its influence on economic development and sustainability.

2.4 Empirical Review

In their study of China, Nan et al. (2022) investigated the role of green innovation in economic growth and carbon emissions. The results revealed that when green innovation is low, there is a significant positive impact on carbon emissions due to economic growth. When green innovation is high, the detrimental effect of economic growth has a carbon reduction effect. Thus, a relationship exists between green innovation and sustainable economic growth. In support of the above findings, Y. Luo, Wang, et al. (2023) asserted that it lessens the harmful influence of economic activities on the environment.

Polas et al. (2023) investigated the effects of adopting green innovation as clean energy strategy by rural entrepreneurs in Bangladesh. A positivist approach was used to examine 288 green entrepreneurs. The findings support the view that the intention to use green energy technologies, such as solar energy, mediates environmental concerns and attitudes towards the adoption of GI. Thus, eco-sustainability is a precursor to sustainable economic development in the emerging economies.

Andersen et al. (2022) focused on green economic change in Africa, particularly on green and circular innovation trends, conditions and dynamics in Kenyan companies. This study investigated how African countries, exemplified in Kenya, experienced a green and circular structural change in their economies. They conducted a mixed survey of 27 manufacturing companies. Their study's conclusions highlight a moderate level of innovation. Circular innovations are relatively more widespread and driven by resource supply. The effectiveness of green innovation is based on adequate capital resources. It was also noted that a shortage of capital was a significant barrier to the success of green entrepreneurs in developing countries.

The goal of German, Redi, Ong, and Liwanag (2023) study was to examine the impact of green innovation initiatives on the competitiveness and financial performance of the land transport industry in the Philippines. Data were gathered through online questionnaires from 206 respondents working at various companies. The findings indicate that the drivers of green innovation initiatives include government pressure, competitor pressure, environmental regulations, and market demand. The study also showed that the implementation of green innovation initiatives positively affects a firm's competitiveness and financial performance. It was also found that green innovation was all-round and applied to all types of businesses, including energy-driven enterprises.

It is clear from the above empirical research that GI plays a catalytic role in the reduction of environmental damage while simultaneously promoting opportunities for sustainable economic development. It can be noted that the barriers that impede GI practices among many entrepreneurs include lack of government support and policy inconsistencies.

3. Research Methodology

This study is underpinned by interpretivist philosophy and a qualitative research perspective. This enabled an in-depth understanding of the study's problem. With this philosophy, the participants' inner thoughts, opinions, feelings, and perceptions were collected in their natural setting (Kivunja & Kuyini, 2017). An exploratory method was used to achieve the goals of this study. The exploratory research design was chosen because studies on green innovation appear new and are less discussed in local research papers and policy documents in Zimbabwe.

3.1 Population and Sample

The population of the study was green entrepreneurs in solar power businesses in Gweru City in the Midlands province of Zimbabwe. Finally, 15 participants participated in the study, involving in-depth face-to-face interviews and focus-group discussions. Purposive and convenient sampling techniques were used to sample participants. Creswell (2014) emphasized that qualitative researchers ought to be purposeful in the identification of participants who could contribute useful and accurate data to the research. Purposive sampling enabled the researcher to obtain detailed information about the topic under investigation.

3.2 Research variables
Independent and dependent variables were used in this study. Green innovation was the independent variable, whereas sustainable economic development was the dependent variable.

3.3 Study site
Gweru is a major city in Midlands Province. It is geographically located at the center of economic activities in Zimbabwe. The major economic activities in the province include corporate, small-scale, and artisanal mining activities. Agricultural activities dominate economic ventures in the provinces. There is a growing trend among farmers to use solar power systems to boost agricultural output through irrigation. Three solar retail shops strategically run their solar power businesses in Gweru City, taking advantage of the demand for solar power systems.

3.4 Data analysis
The analytical method used in this study was a qualitative thematic analysis approach. The data were solicited through in-depth interviews, tape-recorded, and transcribed. This prompted the researcher to use thematic analysis to understand the issues under investigation (Lune & Berg, 2017). The participants verified the validity during and after the analysis to ensure credibility and trustworthiness. Informed consent was obtained before commencement of data collection. The researcher explained the questions to be asked in the interviews and focus group discussions beforehand.

4. Results and discussions
This section presents the results on the role of green innovation in promoting sustainable economic development in Zimbabwe. The results were based on in-depth interviews and focus group discussions. Four themes emerged from the data: These themes included employment creation, carbon emissions reduction, environmental preservation, climate change mitigation, and barriers to the solar system business. There were 7 male and 8 female participants. Male participants were coded as follows: Male participants were coded as Male P1 to P5 and female participants were coded as Female P6 to P10. Finally, focus group members were coded as FGMales 11, 12, 13, FGFemale, 14 and FGFemale15.

4.1 Employment generation
These findings show that green innovation plays an important role in promoting sustainable economic development in Zimbabwe. Some interviewees mentioned that there was a boom in agricultural production, as many farmers resorted to solar-powered irrigation farming. Some of their responses are described below:

> I am a worker here, sales assistant, and assistant technician. Our business focuses on selling and installing solar power systems, which include household systems and borehole drilling. Currently, we do not produce solar panels; however, we are in retail business. Germany, Canada, and Asia are leading producers and suppliers of the proposed solar panel technology. We have ten employees in this company. (Male P3).

> We are committed to this business. It is not yet flourishing but promising because sometimes we are overwhelmed with customers from rural areas who demand services ranging from purchasing to installation. Innovation is gradually taking the center stage. Two of us have established this company, but now we are 10. (Female P6).

> The business of solar power systems is a way to go. The world is going green, and we must move with time. It is an open secret that this business has created significant employment opportunities. Our orders come from China, Germany, and Canada. As a result, employment adds to a country's GDP. Zimbabwe is hit by a high unemployment rate, and people are in dire need of livelihood sources. (Male P1).

> I think green innovation is a kind of business that does not harm the environment in one way or another. For your records, I am the owner of this small business. I employed six young and knowledgeable workers to help me perform my projects. Later, we struck an opportunity. We

> have won a government project to install solar power systems in rural areas for an irrigation project. Thus, employment was created. (Male P5).
>
> The people from Shurugwi bring their farm produce to sale. This implies that green innovation results in job creation. (Female P7).

The responses above indicate that green innovation through solar power systems has resulted in employment for the local people. Irrigation projects powered by solar technology-driven innovations provide sources of income for many people. Power companies are working to reduce poverty in rural communities through employment creation. In addition, green innovation contributes to food security in Midlands Province. Solar power technology is a typical example of the ultimate effect of green innovation, because the environment is protected against any form of destruction. Destek, Ozsoy, and Ozpolat (2020) confirm the positive effects of green innovation, noting that green energy consumption reduced the unemployment rate in Canada, France, Israel, Mexico and New Zealand. Thus, green innovation has become a source of both income and clean energy.

4.2 Reduction of carbon emissions

Another key theme that emerged from the data was reduction in carbon emissions. It was revealed that green innovation reduces the amount of carbon deposits in the atmospheric environment, as long as people use clean energy. This means that fewer negative environmental impacts will occur. It was also noted that some green entrepreneurs specialized in installing solar-powered borehole systems in Zimbabwe's rural areas. Others have teamed up and installed green technology systems to irrigate vegetable gardens.

> Regionally, there are no companies that manufacture panels. Instead, we have to bear the cost of transporting imported green technological innovation materials from either China or Europe. In our company, it is clear that green innovation is a way to go for Zimbabwe. The climate is changing gradually, and the issue of rising temperatures has repercussions on the environment. However, when green innovation is used, the environment is protected from damage. Sustainable innovation reduces global warming by protecting trees from wanton destruction. (FGFemale P12).
>
> Awareness of green innovation is required, considering the rapid climatic changes in Zimbabwe. Tell you what there is uncontrollable destruction and disruption of the environment. Uncontrolled deforestation exacerbates the problem of climate change. However, we are taking green technology innovation to all parts of the country because this innovation to combat climate change should have been adopted decades before. Green innovation is a catalytic tool for promoting sustainable economic development. For instance, many farmers resort to solar-powered irrigation systems that improve food security and reduce carbon emissions. (FGFemale 15).
>
> Let me say that Green innovation is crucial for nurturing a green economy in Zimbabwe. For instance, the government of Zimbabwe intends to introduce solar panel farms similar to those found in China. This was due to the positive impact of GI in reducing the impact of climate change. Clean energy from solar-powered systems has the potential to reduce carbon emissions in the environment. (Female P8).
>
> Green innovation is a way for Zimbabwe to preserve our environment and achieve sustainable economic development. I am sure that if many corporations and home users switch to green technology, environmental pollution will be reduced to a certain extent, which will save lives. In fact, we can breathe clean and safe air because the burning of fossil fuels, which contaminates the environment and affects human health, has been reduced. (Female P10).

As is evident from the above responses, GI has a positive effect on the environment. One effect is that when people resort to green technology, there are fewer carbon emissions. GI is associated with smart

environments in the sense that by reducing carbon emissions, pollutants in the air are reduced and the ozone layer is protected. The results confirm R. Zhang and Fu (2022)'s study findings, which state that in China there was improved resource consumption and that the environmental pollution had steadily reduced, consequently leading to enterprise cost-production. Consistent with the ecological modernization theory, green innovation is about controlling human activities whose main goal is to preserve the environment from destruction due to human activity in the name of business. Businesses adopting green technological innovations promote sustainable economic development. GI is a catalytic tool for poverty alleviation by stepping up agricultural irrigation systems to improve food production.

4.3 Preservation of environment

The findings showed that the interviewees were of the opinion that eco-innovation played an important role in preserving the environment. For example, innovative technology-powered boreholes save the environment from the wanton digging of open wells and erosion. This also provides clean and safe water to the communities. Some interviewees mentioned the following:

> It is not easy to achieve the United's goal of preserving the environment for sustainable development. However, to the best of my knowledge, our solar energy business contributes to environmental preservation in several ways. Our business focuses on renewable energy, a clean energy source. In fact, this is a type of smart energy. Our clientele base consists of rural people who use solar technology for lighting, fridges, irrigation, and boreholes. A large percentage of our customers also live in town, and they want solar systems to be installed instead of resorting to traditional power supplies such as wood. Instead of destroying the environment in order to obtain wood supplies of power, thousands of trees were saved. Thus, sustainable innovation is a good practice. (FGFemale 14).

> Green innovation does not damage the environment because there is likely less land degradation. Researchers believe that businesses that destroy the environment are mainly large-scale and artisanal mining. Furthermore, a business that uses technology-driven innovations reduces its environmental impact by preserving land from adverse human activities. Innovative technology provides a good standard of living. For domestic purposes, green innovation can be used for lighting, powering televisions, radios, fridges, and geysers instead of paraffin, diesel, or coal, which pollute the environment. (Female P9).

> We sell monocrystalline solar panels. These devices are efficient battery chargers. Even if there is cloud cover, the system is reliable and suitable for farming purposes. Imagine that these panels have a 25-year guarantee, meaning that they do not have much running costs. You do not go wrong if you use our solar-driven systems in your homes, gardens, or farms. With less carbon emissions and fewer climate mitigation mechanisms, we can all fight negative climate impacts. (Male P5).

> If people continue to adopt this technology-based power system, the environment can be protected from further degradation. Smart agriculture may instill a positive attitude among people toward saving the environment. As previously mentioned, smart agriculture can reduce gas emissions and water consumption. Green innovation is a form of sustainable economic development, as long as we abstain from fossil fuels. In addition, our organization has service hospitals, schools, and shops with our solar systems. (FGFemale P13).

These responses show that green innovation promotes sustainable economic development through commercial farmers, smallholder farmers, domestic household users, and corporations. Solar power systems that provide clean energy automatically protect the environment from the widespread destruction of firewood poachers. It is apparent that the solar power business is growing, thereby reducing environmentally harmful human activity. Eco-innovation is regarded as a powerful technique for promoting sustainable economic development in Zimbabwe. Gradually, people have been forced to adopt solar power systems to improve their living standards. This is in line with the view of D. Zhang, Ozturk, and Ullah (2022) who underscored that green innovations have become essential factors in

reducing the adverse effects of carbon emissions on human health and the environment as well as improving national economic development.

4.4 Barriers to solar-system businesses

There are also challenges that prevent the effective adoption of green innovation in developing countries, such as Zimbabwe. All government ministries in Zimbabwe have ministerial responsibilities to implement policies that target the achievement of an upper-middle-income economy by 2030, in line with Zimbabwe's Vision 2030. The initiative focuses on climate change, so that there is no reduction in economic performance. The interviewees provided the following responses:

> Our government policies are always changing without any opportunity for consultation or considering the challenges that affect us as green entrepreneurs. These changes are abrupt and affect business. Thus, we need a policy that supports our business initiatives. Thus, we can make a positive contribution to our nation's sustainable economic development. Good support would be provided to financially boost our businesses, which, unfortunately, is not happening. (Male P4).

> However, some government policies lack continuous monitoring. This will stall sustainable economic development in the future. Green innovation in the form of solar power systems has enhanced development. For example, we powered solar-driven robots in towns, hospitals, and schools. However, the 2% tax charged on any form of transaction is draining our profits. Thus, government support is needed to increase the size of our businesses. (FGMale P11).

> There are problems with inflation in Zimbabwe. Therefore, we use a multicurrency system, particularly the US dollar, South African rand, and the Zimbabwe dollar. For those who pay for our services in Zimbabwe dollars, we still need to exchange it with US dollars. We buy solar panels from distant countries such as China, Canada, and Italy. We also place orders from South Africa and Harare, the capital city of Zimbabwe. Despite the hustles we face, the local currency fluctuates perpetually because of the country's hyperinflation. We lose so much in an attempt to transact the US dollar. (FGFemale 13).

The above quotes show that green SME entrepreneurs face challenges brought about by the ever-changing government policies. The interviewees felt that some policies demanded a lot of tax, such as the 2% charged on every item that one buys. Such policies drain business coffers financially and affect operations. The issue of currency instabilities, for instance, the weak value of the Zimbabwe dollar, is a problem because all international transactions are done in US dollars. Narula (2020) endorses this experience when he says that the majority of green SMEs' efforts have been hindered by obstacles in the prevailing environment.

The lack of government support is a drawback. However, green innovation drives businesses in Zimbabwe to increase sustainable economic development. Finance is a key factor for business ventures. Research conducted by Anoke (2023) in Nigeria using microfinance institutions confirms the need for business partners who can inject finance to make businesses resilient. In support of this opinion, Anoke (2023) study in Nigeria underlined that financial services are a critical component of every country's economic growth.

5. Conclusion

This study scrutinized the role of green innovation in promoting sustainable economic development in Gweru City, located in the Midland Province of Zimbabwe. The study used registered small to medium enterprises in the retail business of solar power driven technology. Based on the finding that sustainable innovation plays a catalytic role in promoting sustainable economic development in the city of Gweru in Zimbabwe, this study established the following significant achievements from solar-powered systems. Eco-innovation has brought about clean-safe borehole water powered by solar power, improved agricultural productivity through solar power-driven irrigation schemes, solar robots, and the installation of solar systems in corporations, schools, households, and churches. Green innovation has

contributed to an increase in agricultural production, leading to the generation of employment and improved standards of living. Consequently, this will lead to sustainable economic development in Zimbabwe. Persistent service delivery through solar power technologies ensures available power supplies, less deforestation, and a reduction in the use of fossil fuels. This would protect the environment from carbon emissions and mitigate the problems of climate change and global warming. If this happens, Zimbabwe's green entrepreneurs, such as those in Gweru, could be geared toward national economic buildings. The participants bemoaned less support from the government of Zimbabwe as well as from microfinance institutions. A lack of support for green solar entrepreneurs in the form of expertise, analysis, clarifications, training, and financial support has been documented. In support of this statement, Gazi et al. (2023) stated that business advisors are significant to SME entrepreneurs because they can render assistance in the form of business analysis and guidance, which enhances business performance and efficiency.

Since it has been established that many corporations, farmers, and rural and urban dwellers are now adopting solar power systems in their daily endeavors, it would be prudent for the government of Zimbabwe to implement robust policies and spread awareness on the benefits of the use of solar energy. There is a need to emphasize the importance of sustainable innovation. It is important for the government to spread the word regarding the decreased costs of solar systems, clean energy, environmental preservation, and how best to reduce the negative impact of climate change in the country.

The government should have revolving funds for green SME entrepreneurs so that entrepreneurs can be assisted financially. The Zimbabwe government is encouraged to be a guarantor to lessen the financial burden caused by stringent conditions and collateral attachment. They should also work in partnership with microfinance institutions.

Improving the knowledge of green SME entrepreneurs is critical, especially for farmers transitioning to green farming. They need to participate in seminars and conferences where they share knowledge and skills regarding the use and benefits of sustainable innovation.

5.1 Contribution to knowledge

There is limited literature on green SME entrepreneurship and sustainable innovation, especially in Gweru and other cities in Zimbabwe. This study attempts to address this gap. This study, in its small way, has attempted to chart the role played by green innovation in promoting sustainable economic development in Zimbabwe. Therefore, this study contributes to the expanding body of knowledge on the green innovation agenda for SME entrepreneurs in the solar power systems of Zimbabwe, especially in the Midlands Province of Zimbabwe.

5.2 Limitations of the study

This study is limited to male and female entrepreneurs in Zimbabwe's Midlands Province in Gweru City. This study is also limited to green solar entrepreneurs. Green SME entrepreneurs are involved in solar power installation and retailing services. Statistical data on government taxation, profitability, transport cost, and purchasing cost could not be obtained from entrepreneurs, as much of the data were classified and regarded as confidential.

5.3 Ethical consideration

The researcher sought consent from all participants three days before the data collection process started. The respondents were informed that the collected data would be used for academic purposes only, and all participants were assured that the information solicited would be confidentially treated.

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References

Ahmed, Z., Zhang, B., & Cary, M. (2021). Linking economic globalization, economic growth, financial development, and ecological footprint: Evidence from symmetric and asymmetric ARDL. *Ecological Indicators*, 121, 107060.

Al Doghan, M. A., Abdelwahed, N. A. A., Soomro, B. A., & Ali Alayis, M. M. H. (2022). Organizational environmental culture, environmental sustainability and performance: the mediating role of green HRM and green innovation. *Sustainability*, 14(12), 7510.

Alhijazi, A. A. K., Almasri, R. A., & Alloush, A. F. (2023). A Hybrid Renewable Energy (Solar/Wind/Biomass) and Multi-Use System Principles, Types, and Applications: A Review. *Sustainability*, 15(24), 16803.

Ali, E. B., Anufriev, V. P., & Amfo, B. (2021). Green economy implementation in Ghana as a road map for a sustainable development drive: A review. *Scientific African*, 12, e00756.

Ali, I., Ali, M., Salam, M. A., Bhatti, Z. A., Arain, G. A., & Burhan, M. (2020). How international SME's vicarious learning may improve their performance? The role of absorptive capacity, strength of ties with local SMEs, and their prior success experiences. *Industrial Marketing Management*, 88, 87-100.

Andersen, M. M., Ogallo, E., & Diniz Faria, L. G. (2022). Green economic change in Africa–green and circular innovation trends, conditions and dynamics in Kenyan companies. *Innovation and Development*, 12(2), 231-257.

Anoke, A. F. (2023). Microfinance services and the growth of women entrepreneurial businesses in North Central Nigeria. *Management*, 4(4), 379-393.

Appiah, M. K., Anderson Akolaa, R., & Ayisi-Addo, A. K. (2022). Modeling the impact of macroenvironmental forces on investment in Renewable Energy Technologies in Ghana: the moderating role of Entrepreneurship orientation dimensions. *Cogent Economics & Finance*, 10(1), 2071387.

Asadi, S., Pourhashemi, S. O., Nilashi, M., Abdullah, R., Samad, S., Yadegaridehkordi, E., . . . Razali, N. S. (2020). Investigating influence of green innovation on sustainability performance: A case on Malaysian hotel industry. *Journal of cleaner production*, 258, 120860.

Awan, U., Arnold, M. G., & Gölgeci, I. (2021). Enhancing green product and process innovation: Towards an integrative framework of knowledge acquisition and environmental investment. *Business Strategy and the Environment*, 30(2), 1283-1295.

Bahn-Walkowiak, B., Magrini, C., Berg, H., Gözet, B., O'Brien, M., Arjomandi, T., . . . Graf, V. (2021). Eco-innovation and digitalisation: case studies, environmental and policy lessons from EU member states for the EU green deal and the circular economy: EIO biennial report 2020.

Bai, Y., Song, S., Jiao, J., & Yang, R. (2019). The impacts of government R&D subsidies on green innovation: Evidence from Chinese energy-intensive firms. *Journal of cleaner production*, 233, 819-829.

Bali Swain, R., & Yang-Wallentin, F. (2020). Achieving sustainable development goals: predicaments and strategies. *International Journal of Sustainable Development & World Ecology*, 27(2), 96-106.

Baumgartner, R. J., & Ebner, D. (2010). Corporate sustainability strategies: sustainability profiles and maturity levels. *Sustainable development*, 18(2), 76-89.

Chen, Y.-S., Lai, S.-B., & Wen, C.-T. (2006). The influence of green innovation performance on corporate advantage in Taiwan. *Journal of Business Ethics*, 67, 331-339.

Creswell, J. W. (2014). Research design: qualitative, quantitative, and mixed methods approaches.

Destek, M. A., Ozsoy, F. N., & Ozpolat, A. (2020). Investigation on the job creation effect of green energy in OECD countries. *Econometrics of Green Energy Handbook: Economic and Technological Development*, 131-149.

Eiadat, Y., Kelly, A., Roche, F., & Eyadat, H. (2008). Green and competitive? An empirical test of the mediating role of environmental innovation strategy. *Journal of World Business,* 43(2), 131-145.

Forcadell, F. J., Úbeda, F., & Aracil, E. (2021). Effects of environmental corporate social responsibility on innovativeness of spanish industrial SMEs☆,☆☆,★,★★. *Technological Forecasting and Social Change,* 162, 120355.

German, J. D., Redi, A. A. N. P., Ong, A. K. S., & Liwanag, J. L. (2023). The impact of green innovation initiatives on competitiveness and financial performance of the land transport industry. *Heliyon,* 9(8).

Hák, T., Janoušková, S., & Moldan, B. (2016). Sustainable Development Goals: A need for relevant indicators. *Ecological Indicators,* 60, 565-573.

Hao, Y., Guo, Y., & Wu, H. (2022). The role of information and communication technology on green total factor energy efficiency: does environmental regulation work? *Business Strategy and the Environment,* 31(1), 403-424.

He, H., Wang, C., Wang, S., Ma, F., Sun, Q., & Zhao, X. (2021). Does environmental concern promote EV sales? Duopoly pricing analysis considering consumer heterogeneity. *Transportation Research Part D: Transport and Environment,* 91, 102695.

Ibrahim, R. L., Ozturk, I., Al-Faryan, M. A. S., & Al-Mulali, U. (2022). Exploring the nexuses of disintegrated energy consumption, structural change, and financial development on environmental sustainability in BRICS: modulating roles of green innovations and regulatory quality. *Sustainable Energy Technologies and Assessments,* 53, 102529.

Kartika, A. D., & Medlimo, R. A. (2022). Development Taman Surya Nusantara to Increase New and Renewable Energy in Indonesia. *Journal of Sustainable Tourism and Entrepreneurship,* 3(4), 301-312.

Khan, P. A., Johl, S. K., & Johl, S. K. (2021). Does adoption of ISO 56002-2019 and green innovation reporting enhance the firm sustainable development goal performance? An emerging paradigm. *Business Strategy and the Environment,* 30(7), 2922-2936.

Khan, S. J., Dhir, A., Parida, V., & Papa, A. (2021). Past, present, and future of green product innovation. *Business Strategy and the Environment,* 30(8), 4081-4106.

Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education,* 6(5), 26-41.

Kneipp, J. M., Gomes, C. M., Kruglianskas, I., Motke, F. D., & Frizzo, K. (2021). Sustainable innovation practices and the degree of innovation of business models in Brazilian industrial companies. *World Journal of Science, Technology and Sustainable Development,* 18(3), 221-238.

Kumar, C. M. S., Singh, S., Gupta, M. K., Nimdeo, Y. M., Raushan, R., Deorankar, A. V., . . . Pakhale, V. D. (2023). Solar energy: A promising renewable source for meeting energy demand in Indian agriculture applications. *Sustainable Energy Technologies and Assessments,* 55, 102905.

Li, L., Msaad, H., Sun, H., Tan, M. X., Lu, Y., & Lau, A. K. (2020). Green innovation and business sustainability: New evidence from energy intensive industry in China. *International journal of environmental research and public health,* 17(21), 7826.

ling Guo, L., Qu, Y., & Tseng, M.-L. (2017). The interaction effects of environmental regulation and technological innovation on regional green growth performance. *Journal of cleaner production,* 162, 894-902.

Lune, H., & Berg, B. L. (2017). Qualitative research methods for the social sciences: Pearson.

Luo, X., & Oyedele, L. O. (2021). Assessment and optimisation of life cycle environment, economy and energy for building retrofitting. *Energy for Sustainable Development,* 65, 77-100.

Luo, Y., Lu, Z., & Wu, C. (2023). Can internet development accelerate the green innovation efficiency convergence: Evidence from China. *Technological Forecasting and Social Change,* 189, 122352.

Luo, Y., Wang, Q., Long, X., Yan, Z., Salman, M., & Wu, C. (2023). Green innovation and SO2 emissions: Dynamic threshold effect of human capital. *Business Strategy and the Environment*, 32(1), 499-515.

Ma, Y., Hou, G., Yin, Q., Xin, B., & Pan, Y. (2018). The sources of green management innovation: does internal efficiency demand pull or external knowledge supply push? *Journal of cleaner production*, 202, 582-590.

Maasoumi, E., Heshmati, A., & Lee, I. (2021). Green innovations and patenting renewable energy technologies. *Empirical economics*, 60, 513-538.

Maka, A. O., & Alabid, J. M. (2022). Solar energy technology and its roles in sustainable development. *Clean Energy*, 6(3), 476-483.

Mirzaei, T., & Esmaeilzadeh, P. (2021). Engagement in online health communities: channel expansion and social exchanges. *Information & Management*, 58(1), 103404.

Moslehpour, M., Chang, M.-L., & Dadvari, A. (2022). Adopting the configurational approach to the analysis of job satisfaction in Mongolia. *European Research on Management and Business Economics*, 28(1), 100179.

Mubarak, M. F., Tiwari, S., Petraite, M., Mubarik, M., & Raja Mohd Rasi, R. Z. (2021). How Industry 4.0 technologies and open innovation can improve green innovation performance? *Management of Environmental Quality: An International Journal*, 32(5), 1007-1022.

Najmi, A., Kanapathy, K., & Aziz, A. (2021). Understanding consumer participation in managing ICT waste: Findings from two-staged Structural Equation Modeling–Artificial Neural Network approach. *Environmental Science and Pollution Research*, 28, 1-15. doi:10.1007/s11356-020-11675-2

Nan, S., Wang, Z., Wang, J., & Wu, J. (2022). Investigating the role of green innovation in economic growth and carbon emissions nexus for China: New evidence based on the PSTR Model. *Sustainability*, 14(24), 16369.

Narula, R. (2020). Policy opportunities and challenges from the COVID-19 pandemic for economies with large informal sectors. *Journal of international business policy*, 3, 302-310.

Niamir, L., Ivanova, O., Filatova, T., Voinov, A., & Bressers, H. (2020). Demand-side solutions for climate mitigation: Bottom-up drivers of household energy behavior change in the Netherlands and Spain. *Energy Research & Social Science*, 62, 101356.

Polas, M. R. H., Kabir, A. I., Jahanshahi, A. A., Sohel-Uz-Zaman, A. S. M., Karim, R., & Tabash, M. I. (2023). Rural entrepreneurs behaviors towards green innovation: Empirical evidence from Bangladesh. *Journal of Open Innovation: Technology, Market, and Complexity*, 9(1), 100020.

Ramdani, D., & Prayitno, Y. H. (2023). The leverage and company size impact on delay in the audit. *International Journal of Financial, Accounting, and Management*, 5(3), 265-279.

Sadiq, M., Amayri, M. A., Paramaiah, C., Mai, N. H., Ngo, T. Q., & Phan, T. T. H. (2022). How green finance and financial development promote green economic growth: deployment of clean energy sources in South Asia. *Environmental Science and Pollution Research*, 29(43), 65521-65534.

Samour, A., Baskaya, M. M., & Tursoy, T. (2022). The impact of financial development and FDI on renewable energy in the UAE: a path towards sustainable development. *Sustainability*, 14(3), 1208.

Savarese, C., Huybrechts, B., & Hudon, M. (2021). The influence of interorganizational collaboration on logic conciliation and tensions within hybrid organizations: Insights from social enterprise–corporate collaborations. *Journal of Business Ethics*, 173, 709-721.

Schiederig, T., Tietze, F., & Herstatt, C. (2012). Green innovation in technology and innovation management–an exploratory literature review. *R&D Management*, 42(2), 180-192.

Shahzad, M., Qu, Y., Zafar, A. U., & Appolloni, A. (2021). Does the interaction between the knowledge management process and sustainable development practices boost corporate green innovation? *Business Strategy and the Environment*, 30(8), 4206-4222.

Shahzad, M., Qu, Y., Zafar, A. U., Ding, X., & Rehman, S. U. (2020). Translating stakeholders' pressure into environmental practices–The mediating role of knowledge management. *Journal of cleaner production*, 275, 124163.

Sharif, A., Raza, S. A., Ozturk, I., & Afshan, S. (2019). The dynamic relationship of renewable and nonrenewable energy consumption with carbon emission: a global study with the application of heterogeneous panel estimations. *Renewable energy*, 133, 685-691.
Shin, J., Kim, Y. J., Jung, S., & Kim, C. (2022). Product and service innovation: Comparison between performance and efficiency. *Journal of Innovation & Knowledge*, 7(3), 100191.
Singh, S. K., Del Giudice, M., Chierici, R., & Graziano, D. (2020). Green innovation and environmental performance: The role of green transformational leadership and green human resource management. *Technological Forecasting and Social Change*, 150, 119762.
Sulaiman, E., Fitralisma, G., Fata, M. A., & Nawawi, R. (2023). Empowering local communities engagement: Rural tourism and business innovation for SDGs desa. *Journal of Sustainable Tourism and Entrepreneurship*, 4(3), 331-344.
Supheni, I., Ivada, E., Novianti, G. E., & Wiwin, W. (2022). Sustainable tourism from the perspective of tourists in Nganjuk Indonesia. *Journal of Sustainable Tourism and Entrepreneurship*, 3(3), 235-252.
Supheni, I., Ivada, E., Novianti, G. E., & Wiwin, W. (2023). Sustainable tourism from the perspective of tourists in Nganjuk Indonesia. *Journal of Sustainable Tourism and Entrepreneurship*, 4(3), 301-318.
Tang, C., Xu, Y., Hao, Y., Wu, H., & Xue, Y. (2021). What is the role of telecommunications infrastructure construction in green technology innovation? A firm-level analysis for China. *Energy Economics*, 103, 105576.
Tu, Y.-T., Aljumah, A. I., Van Nguyen, S., Cheng, C.-F., Tai, T. D., & Qiu, R. (2023). Achieving sustainable development goals through a sharing economy: Empirical evidence from developing economies. *Journal of Innovation & Knowledge*, 8(1), 100299.
UNSD. (1987). *Report of the World Commission on Environment and Development: Our Common Future*. Retrieved from https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf
UNSD. (1992). *Agenda 21*. Retrieved from https://sustainabledevelopment.un.org/outcomedocuments/agenda21
Wang, H., Lian, X., & Lin, D. (2016). Effects of green technological innovation efficiency on regional green growth performance: An empirical analysis. *Sci. Sci. Manag. ST*, 37, 80-87.
Xie, X., Huo, J., & Zou, H. (2019). Green process innovation, green product innovation, and corporate financial performance: A content analysis method. *Journal of Business Research*, 101, 697-706.
Xue, Y., Jiang, C., Guo, Y., Liu, J., Wu, H., & Hao, Y. (2022). Corporate social responsibility and high-quality development: do green innovation, environmental investment and corporate governance matter? *Emerging Markets Finance and Trade*, 58(11), 3191-3214.
Yang, B., Jahanger, A., Usman, M., & Khan, M. A. (2021). The dynamic linkage between globalization, financial development, energy utilization, and environmental sustainability in GCC countries. *Environmental Science and Pollution Research*, 28, 16568-16588.
Zeng, S., Tanveer, A., Fu, X., Gu, Y., & Irfan, M. (2022). Modeling the influence of critical factors on the adoption of green energy technologies. *Renewable and Sustainable Energy Reviews*, 168, 112817.
Zhang, D., Ozturk, I., & Ullah, S. (2022). Institutional factors-environmental quality nexus in BRICS: a strategic pillar of governmental performance. *Economic research-Ekonomska istraživanja,* 35(1), 5777-5789.
Zhang, R., & Fu, Y. (2022). Technological progress effects on energy efficiency from the perspective of technological innovation and technology introduction: An empirical study of Guangdong, China. *Energy Reports*, 8, 425-437.
Zhuang, Y., Yang, S., Razzaq, A., & Khan, Z. (2022). Environmental impact of infrastructure-led Chinese outward FDI, tourism development and technology innovation: a regional country analysis. *Journal of Environmental Planning and Management*, 66(2), 367-399.